

REMARKS

This is in response to the Office Action that was mailed on October 24, 2006. Claim 1 is amended to incorporate features of claim 3 and to recite features of the invention based, for instance, on disclosure in lines 12-20 on page 4 of the specification (alkenyl content) and in lines 8-11 on page 4 of the specification (molecular weight). The amendment to claim 2, and new claim 8, are based upon the formulae recited on page 5 of the specification. New claims 9 and 10 are based upon working Examples 1 and 2, respectively. No new subject matter is introduced into the application by this Amendment.

THE INVENTION. The present invention provides heat-curable fluoropolyether rubber compositions which include at least components (A), (B), and (C). Component (A) is a straight-chain perfluoropolyether compound having at least three alkenyl groups in both ends of a molecule. Component (B) is a reinforcing filler. Component (C) is an organic peroxide. The crosslinking method used with the inventive compositions is a radical reaction using organic peroxides. The present fluoropolyether rubber compositions are freed of cure inhibition by catalyst poisons. They cure into rubber parts having improved properties, including heat resistance, chemical resistance, solvent resistance, parting property, water repellency, oil repellency, and low-temperature properties. The compositions presently claimed are neither taught nor suggested by the prior art of record.

US 7,087,673. Claims 1-7 were rejected as constituting double patenting with respect to claims 1-4 of US 7,087,673 B2. Office Action, pages 2-3. Claims 1-7 were rejected under 35 USC §102 as being anticipated by US 7,087,673 B2. Office Action, page 8. Both of these rejections are respectfully traversed. In contrast to the present invention, US 7,087,673 discloses a crosslinkable fluororubber composition comprising (A) a polymer of the formula $Z-(Rf-Q)_n-Rf-Z$ wherein n is an integer of at least 1, Rf is a divalent perfluoroalkylene or perfluoroalkoxyalkylene radical, Q is a divalent organic radical, and Z is a monovalent organic radical, having a viscosity of at least 1,000 Pas at 25°C, (B) a reinforcing filler, and (C) a

peroxide crosslinking agent. However, even though the divalent organic radical as Q in component (A) of US 7,087,673 contains an alkenyl group (claim 1, formula (5), R^5) capable of radical reaction by a peroxide crosslinking agent, it is attached to backbone (main chain) in the molecule, not attached to both ends of a molecule. In contrast, in the present invention at least three alkenyl groups are attached at both ends of the component (A) molecule. Therefore, the present claims distinguish patentably over US 7,087,673 B2.

US 6,576,701. Claims 1-5 were rejected as constituting double patenting with respect to claims 1-19 of US 6,576,701 B2. Office Action, page 3. Claims 1-7 were rejected under 35 USC §102 as being anticipated by US 6,576,701 B2. Office Action, pages 7-8. Both of these rejections are respectfully traversed. In contrast to the present invention, US 6,576,701 discloses a crosslinkable fluororubber composition comprising: (A) a perfluoro compound having at least two alkenyl groups and a divalent perfluoroalkylene or perfluoropolyether structure in the backbone or a polymer obtained by adding a compound having at least two hydrosilyl groups in the molecule to some alkenyl groups on the perfluoro compound; (B) a reinforcing filler; (C) an addition reaction crosslinking agent having a hydrosilyl group or a peroxide crosslinking agent; and (D) a surface treating agent having at least one fluoroalkyl or fluoropolyalkyl ether group and silanol groups is improved in heat resistance in the cured state by adding thereto (E) a heat resistance modifier selected from carbon black, metal oxides and metal hydroxides. However, briefly, the perfluoro compound as component (A) in this reference is a polymer shown in formula (1) of claim 2, or it contains its backbone-expanding polymer obtained by addition reaction of its two alkenyl groups with two hydrosilyl groups of another compound having the same. In any case, substantially, the perfluoro compound as component (A) in US 6,576,701 is a polymer having two alkenyl groups at both ends. In contrast, the alkenyl groups in component (A) of the present invention are attached in an amount of at least three into both ends of a molecule. It goes without saying that in the present invention the alkenyl groups do not contribute to backbone-expansion of the molecule. Therefore, the present claims distinguish patentably over US 6,576,701 B2.

US 6,825,267. Claims 1-5 were rejected as constituting double patenting with respect to claims 1-9 of US 6,825,267 B2. Office Action, pages 3-4. This ground of rejection should be withdrawn. US 6,825,267 discloses a fluororubber composition comprising (A) a liquid perfluoro compound having at least two alkenyl groups and a divalent perfluorolalkylene or perfluoropolyether structure, (B) a compound capable of addition reaction having at least two hydrosilyl groups, components (A) and (B) being combined and precured in the presence of an addition reaction catalyst to form a precured base, (C) a reinforcing filler, and (D) a peroxide crosslinking agent containing an isopropyl monocarbonate group has improved solvent resistance, chemical resistance, heat resistance, and low-temperature properties, as well as satisfactory rubber physical properties, especially strength. In US 6,825,267, the liquid perfluoro compound used as component (A) is a polymer shown in formula (1) of claim 2. It expands its backbone by addition reaction of its two alkenyl groups with two hydrosilyl groups of component (B). In the invention of US 6,825,267, because a molar ratio of hydrosilyl groups in component (B) to alkenyl groups in component (A) is 0.1/1 to 0.99/1 (claim 1), as the result of said addition reaction, some alkenyl groups appear to remain in the product (precured base). However, the product (precured base) appears still to have two alkenyl groups in both ends of the molecule. In contrast, at least three alkenyl groups, in the present invention, are attached at both ends of the component (A) molecule. In this invention, the alkenyl groups do not contribute to backbone-expanding of the molecule. Therefore, the compositions of US 6,825,267 differ in an essential from those of the present invention, at least in the molecule structure of component (A) and the resulting curing structure thereof.

CAPORICCIO. Claims 1 and 4-7 were rejected under 35 USC §102 as being anticipated by US 4,080,319 (Caporiccio). Office Action, page 5. The rejection is respectfully traversed. Caporiccio discloses a class of elastomeric copolymers, the chains of which contain perfluoropolyether radicals having a linear structure, linked through cycloimide groups to organic radicals of different and suitable structures. Caporiccio also discloses a process for preparing such copolymers which comprises condensing a mixture of fluorinated polyether diamines with one or more tetracarboxylic dianhydrides or esters. Caporiccio's elastomeric

copolymer is a perfluoropolyether compound having diamine in its end. It reacts with tetracarboxylic dianhydride to a form elastomeric copolymer with repeating units of perfluoropolyether and imide ring. Therefore, the elastomeric copolymer of Caporiccio does not contain a hexa-propylene structure as in the present invention. The Caporiccio disclosure also differs significantly with respect to the curing structure of disclosed rubber articles. The present claims distinguish patentably over the Caporiccio disclosure.

OKI. Claims 1 and 4-7 were rejected under 35 USC §102 as being anticipated by US 5,208,293 (Oki). Office Action, page 5. The rejection is respectfully traversed. Oki discloses a rubber composition comprising at least one thermoplastic fluoro resin as a first ingredient selected from the group consisting of a tetrafluoroethylene-ethylene copolymer, a tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer, and a tetrafluoroethylene-hexafluoropropylene copolymer, a thermoset fluororubber as a second ingredient, and a tetrafluoroethylene polymer as a third ingredient represented by the formula: $-(CF_2-CF_2)_n-$. However, Oki merely lists a fluoropolyether having a main structural unit of $-C_nF_{2n}-O-$ (n is 1, 2, 3, or 4) and having an average molecular weight of 50,000 or less (column 4, lines 3-5). Oki fails to teach or suggest a fluoropolyether with a vinyl group in its structure as in the present claims. Accordingly, the present claims distinguish patentably over the Oki disclosure.

GUERRA. Claims 1 and 4-7 were stated on page 6 of the Office Action to be rejected under 35 USC §102 as being anticipated by US 5,226,650. US 5,226,650 is directed to a tennis racket. Applicants presume that the Examiner intended US 5,384,374 to Miguel Guerra, *et al.* (Guerra). In any case, the rejection in question is respectfully traversed. Guerra discloses a fluorocarbon elastomer composition comprising (A) fluorocarbon elastomer gum, and (B) monohydroxy terminated fluorinated mono- or polyether of linear and regular structure, wherein said hydroxy is reactive with said gum. However, Guerra fails to disclose fluorinated ether as component (B) having at least three alkenyl groups in both ends of a molecule. Furthermore, because the fluorinated ether is a number average molecular weight between 250 and 3000, it differs from perfluoropolyether compound of the present invention having a number average

molecular weight of 5000 to 25,000. Therefore, Guerra's invention differs significantly from the present invention.

SAITO. Claims 1 and 4-7 were rejected under 35 USC §102 as being anticipated by US 5,717,036 (Saito). Office Action, page 6. The rejection is respectfully traversed. Saito discloses a copolymer comprising 0.005 to 1.5 mole % of repeating units derived from an iodine-containing fluorinated vinyl ether, 40 to 90 mole % of repeating units derived from vinylidene fluoride, 3 to 35 mole % of repeating units derived from perfluoro(methyl vinyl ether), optionally up to 25 mole % of repeating units derived from hexafluoropropylene, and optionally up to 40 mole % of repeating units derived from tetrafluoroethylene. This copolymer is obtained by polymerizing the above monomers in the presence of a diiodide compound. It contains iodine atoms introduced in the copolymer from the diiodide compound and the iodine-containing fluorinated vinyl ether in amounts of 0.01 to 1 wt. % and 0.01 to 2 wt. %, respectively, and has a Mooney viscosity of 20 to 150. Saito's invention is a radical copolymer comprising a fluorine compound such as a vinylidene fluoride. Therefore, Saito's invention differs significantly from the present invention, and accordingly does not anticipate the present invention.

BARBIERI. Claims 1 and 4-7 were rejected under 35 USC §102 as being anticipated by US 6,005,054 (Barbieri). Office Action, pages 6-7. The rejection is respectfully traversed. Barbieri discloses additives of the classes mono- and/or di-hydroxypolyfluoroethers comprising fluoropolyoxyalkylenic repeating units chosen from the following moieties: (C_3F_6O) ; $(CFXO)$ wherein $X=F, CF_3$; $(CH_2CF_2CF_2O)$; $(CF_2(CF_2)_zCF_2O)$ wherein z is an integer equal to 1 or 2; and (C_2F_4O) , in curable compositions of fluoroelastomers to improve the coefficient of friction without lowering the adhesion with bonding agents to metal reinforcements. However, Barbieri merely lists some hydroxypolyfluoroethers comprising the fluoropolyoxyalkylenic repeating units as additives. The reference fails to disclose hydroxypolyfluoroethers being cured, much less cured structures made from them. Therefore, Barbieri's invention differs significantly from the present invention, and accordingly does not anticipate the present invention.

TANAKA. Claims 1 and 4-7 were rejected under 35 USC §102 as being anticipated by US 6,703,461 B1 (Tanaka). Office Action, page 7. The rejection is respectfully traversed. Tanaka discloses a fluorine-containing elastomer, wherein an ashed product of said fluorine-containing elastomer has a metal content of not more than 50 ppm. However, Tanaka's invention differs significantly from the present invention in technical field, and accordingly does not anticipate the present invention.

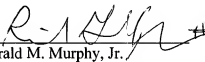
As demonstrated above, none of the rejections of record is sustainable with respect to the claims presently before the Examiner. As a general comment, it is not clear why the Examiner has stated 11 different rejections against Applicants' invention. There were almost twice as many rejections as there were claims in this application! In any future prosecution, the Examiner is respectfully requested to settle upon and apply only the two or three "best" references against the claims, in order to reduce the burden of prosecution that is placed on Applicants. Applicants believe, however, that the Examiner will recognize that the claims currently before her clearly distinguish over each and every piece of prior art that has been cited herein.

If there are any questions, the Examiner is invited to contact Richard Gallagher, Registration No. 28,781, at (703) 205-8008.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.14; particularly, extension of time fees.

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Respectfully submitted,

By  # 28,977

Gerald M. Murphy, Jr.

Registration No.: 28,977

BIRCH, STEWART, KOLASCH & BIRCH, LLP
8110 Gatehouse Road
Suite 100 East
P.O. Box 747
Falls Church, Virginia 22040-0747
(703) 205-8000
Attorneys for Applicant